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PART II. Choose the best answer and write the letter of your choice on the space provided. (1.5pts each)

1. B Which one of the following is always true?
   A) The sum of any two irrational numbers is irrational.
   B) The sum of any two rational numbers is rational.
   C) The product of any two irrational numbers is irrational.
   D) The product of a rational and an irrational numbers is irrational.

2. B For natural numbers x and y, which statement is false?
   A. $(\forall x)$ $2x$ is even.
   B. $(\exists x)(\forall y) x \leq y$.
   C. $(\forall x)(\exists y)\ y < x$.
   D. $(\forall x)(\forall y)\ (x+y)^2$ is composite.

3. D For any set A, if $A * A' = A$, then the set operation * is:
   A. $\cup$ B. $\cap$ C. Δ D. $\setminus$ E. None of the above

4. E Let $A = \{\{(\phi)\}, \{\phi\}, \phi\}$. Then which one is not true?
   A. $\{(\phi)\} \subseteq A$ B. $\{(\phi)\} \in A$ C. $\{\phi, \{\phi\}\} \subset A$ D. $\{\{(\phi)\}\} \in P(A)$ E. None of the above

5. D Which one of the following is **false** about any two sets A and B?
   A. $A \subset B \Rightarrow B' \subset A'$
   B. $A = B \Rightarrow A' = B'$
   C. $A' - B' = B - A$
   D. $(A' \cap B)' \cap B = B$

PART III. Write the most simplified form of your answer on the space provided. (1.5 pts each)

1. In polar form, $(1-i)^{12} =$ $64(\cos 3\pi + i \sin 3\pi)$
2. The complex number(s) z for which $\mathrm{Re}(z^2) = 0$ and $\mathrm{Im}(z^2) = 2$ is (are) $\sqrt{2}i$, $-\sqrt{2}i$.
3. Write one of the fifth roots of $-32i$.
4. The identity element in the operation union of sets is empty set.
5. Let $z = \sqrt{6 - 6\sqrt{3}i}$, then the polar form of z is $2\sqrt{6}(\cos \pi + i \sin \pi/3)$.

1600

DEBRE TABOR UNIVERSITY
FACULTY OF NATURAL AND COMPUTATIONAL SIENCES
DEPARTMENT OF MATHEMATICS
Math 1011 Test (30 %)

YEAR II
Department: Social Science
PROGRAM: REGULAR
DATE OF EXAM: 13/04/2012
TIME ALLOWED: 2:00 Hrs

me _____ ID No. _____

eneral Instructions

- *Read instructions carefully.*
- *Do not turn this page until you are told to do so.*
- *Check whether this exam has 18 questions in **four** parts with **five** pages including the cover page.*
- *Read each part of the exam carefully.*
- *Your answer should be readable, neat with necessary steps.*
- *Do not detach any single page from this booklet; otherwise it will not be marked.*
- *Use of **pencil** and **red pen** is strictly forbidden.*
- *Switch of your **mobile**.*
- *Take your seat properly.*
- *Any form of cheating will make your result **0**.*

For Instructor's use only

Part I (7 marks)	Part II (4 marks)	Part III (4 marks)	Part IV (15 marks)	Total (30 marks)

Part I: True or False

Instruction: Write **True** if the statements are correct and write **False** if the statements are incorrect only on the space provided. **(1 points each)**

[redacted] 1. The statement forms $\neg(p \wedge q)$ and $\neg p \wedge \neg q$ are not **logically** equivalent.

[redacted] 2. Let R be a relation on the set $A = \{1,2,3,4\}$ defined by $R = \{(a,b): 2 \text{ divides } b-a\}$, then $R = \{(1,1),(2,2),(3,3),(4,4),(1,3),(2,4)\}$.

[redacted] 3. If $a \leq b$, then $-a \leq -b, \forall\, a, b \in \mathbb{R}$.

[redacted] 4. If the domain consists of all integers, then the truth value of the statement $\exists n(2n = 3n)$ is always true.

[redacted] 5. If a compound statement $p \Longrightarrow q$ has truth value **F**, then the statement $q \Longrightarrow \neg p$ has truth value **T**.

[redacted] 6. $\{0\} \in \{0\}$.

[redacted] 7. For all sets A and B, $A \cup (A \cap B) = A$.

Part II: Fill in the blank spaces

Instruction: Write the correct and most simplified answer for the following only on the spaces provided.

(1 point each)

1. The negation of the quantified statement "$\exists x\, \neg P\,(x)$" is [redacted]
2. Number of elements in the set $\{1, \{1\}, \{1, \{1\}\}\}$ is [redacted]
3. The power set of the set $\{\emptyset, \{\emptyset\}\}$ is [redacted].
4. The solution of the inequality $4x + \frac{2}{3} \leq 2x - (3x+1)$ is [redacted].

Part III: Multiple Choices

Instruction: Choose the best answer for the following and write the letter of your choice only on the space provided.

(1 points each)

1. Which of the following is true.
   a) $0 \in \emptyset$ b) $\emptyset \in \{0\}$ c) $\{0\} \subset \{0\}$ d) $\{\emptyset\} \subseteq \{\emptyset\}$

2. Let $A \cup B = \{a, b, c, d, e, x, y, z\}$ and $A \cap B = \{b, e, y\}$. If $B - A = \{x, z\}$. Then A is
   a) $\{a, b, c, x, y\}$ b) $\{a, b, c, d, e, y\}$ c) $\{a, c, d, e, x, y\}$ d) $\{d, e, x, y, z\}$

3. The product of two numbers is 5. If their sum is $\frac{9}{2}$. Then the numbers are equal to
   a) $2 \& \frac{1}{2}$ b) $2 \& \frac{7}{2}$ c) $2 \& \frac{5}{2}$ d) $2 \& \frac{3}{2}$

4. Let $A = \{1.2\}$ and $B = \{a, \emptyset, b\}$. Which of the following relations is a function from A into B?
   a) $f_1 = \{(1, a), (1, \emptyset), (2, b)\}$
   b) $f_2 = \{(1, \emptyset), (2, b)\}$
   c) $f_3 = \{(1, a), (2, \emptyset), (2, b)\}$
   d) $f_4 = \{(1, a), (1, \emptyset), (2, a), (2, \emptyset)\}$

Part IV: Work out

Instruction: Show all the necessary steps and write your answer neatly and clearly for the following questions on the space provided.

5 points each

1. Show that the argument $p \Rightarrow q, \neg p \Rightarrow r, r \Rightarrow s \vdash \neg q \Rightarrow s$ is valid.

3. Let $f(x) = 3x^2 - 4x + 2$ and $g(x) = \sqrt{x+5}$. Then find
   a) $(f+g)(x)$ and its domain.
   b) $(f \circ g)(x)$ and $(g \circ f)(x)$

DEBRE MARKOS UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
DEPARTMENT OF MATHEMATICS
MATHEMATICS FOR NATURAL SCIENCE (Math 1011) TEST (30%)

22.5/30

Time allowed 1:45
Date: Dec 17/2019

Name [redacted] I[redacted] Sectio[redacted]

- ATTEMPT ALL QUESTIONS ACCORDINGLY.
- CHECK THAT THE EXAM BOOKLET CONTAINS THREE DIFFERENT PAGES.
- CALCULATOR, MOBILE PHONES AND ROUGH PAPERS ARE NOT ALLOWED.
- ANY FORM OF CHEATING RESULTS IN CANCELLATION OF MARKS.

PART I. Write True or False according to the statements below. (1 pt each)

1. True If the truth values of the statements p, q, r and s are, respectively T, T, F and F, then $[(\neg p \vee q) \wedge s] \Leftrightarrow (\neg r \Rightarrow \neg q)$ is true.
2. False Every non empty set A is a proper subset of itself.
3. False Every real number has an additive inverse.
4. True The complex conjugate of any real number is itself.
5. False If the truth value of the statement $(p \vee q)$ is F, then $p \Leftrightarrow q$ is also F.

IV. Workout: Show all necessary steps on the spaces provided.

1. Show that, $2^n \leq (n+1)!$, *for* $n \geq 0$ using the principle of mathematical induction. **(4 pts)**

$2^n \leq (n+1)!$ $n \geq 0$

Step 1: for $n=0$ $2^0 \leq (0+1)!$

$1 \leq 1$ which is True

Step 2: Assume that for $n=k$

$2^k \leq (k+1)!$ it is true

Step 3: Claim: for $n=k+1$

$2^{k+1} \leq (k+1+1)!$

$2^k \cdot 2 \leq (k+2)!$

$2^k \cdot 2 \leq (k+1)(k+2)$

So ∴ when it True for $n=k+1$ $2^{k+1} \leq (k+1)!$ when it True

2. Find the complex solutions of $z^2 - 2z + 5 = 0$. **(3 pts)**

let: $z = x+yi$

$z^2 - 2z + 5 = 0$

$(x+yi)^2 - 2(x+yi) + 5 = 0$

$(x^2 + 2xyi - y^2) - 2(x+yi) + 5 = 0$

$x^2 + 2xyi - y^2 - 2x - 2yi + 5 = 0$

$(x^2 - y^2 - 2x + 5) + 2xyi - 2yi = 0$

$(x^2 - y^2 - 2x + 5) + i(2xy - 2y) = 0 + 0i$

$x^2 - y^2 - 2x + 5 = 0$ and $2xy - 2y = 0$

$2xy - 2y = 0$

$2y(x-1) = 0$

$y = 0$ $x - 1 = 0$

$x = 1$

at $y=0$

$x^2 - 2x + 5 = 0$ it has no real value

so we should have to have $x=1$

at $x=1$

$1^2 - y^2 - 2(1) + 5 = 0$

$1 - y^2 - 2 + 5 = 0$

$-y^2 + 1 - 2 + 5 = 0$

$-y^2 + (-1) + 5 = 0$

$-y^2 + 4 = 0$

$-y^2 = -4$

$\sqrt{y^2} = \sqrt{4}$

$y = \pm 2$

then $y = -2$ $x = 1$

$y = 2$ $x = 1$

then $z = 1 - 2i$ and $z = 1 + 2i$

3. Find the *lub* and *glb* (if any) of the set $\left\{8 - \frac{1}{n} : n \geq 1\right\}$. **(3 pts)**

$\{7, 7.5, \ldots, 8\}$

$\Rightarrow$ glb = 8

$\Rightarrow$ lub = 7